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The effect of 107th OPEC Ordinary Meeting on oil prices and economic performances in Japan

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ABSTRACT

The aim of this paper is to show the influence of the 107th OPEC Ordinary Meeting (meeting) and investigates the relationships between oil prices and economic activities, using an exponential generalized autoregressive conditional heteroskedasticity (EGARCH) and a vector autoregressive (VAR) model from 1991 to 2008 in Japan. We find that levels and volatilities of oil prices increase after the meeting. We examine the effects of it on Japanese economic activities, employing a Granger-causality test and data before and after it. The empirical result reveals that each price of regular gasoline and diesel has information to be useful to predict the economy after the meeting. On the other hand, volatilities of regular gasoline and diesel price have information to predict the inflation and economic growth before the meeting, respectively. After the meeting, however, these volatilities change to be useful to predictive both inflation and economic growth. Thus, we conclude that the decision of meeting is related to not only the domestic oil prices, but also the macroeconomy.

Contents

1. Introduction

Crude oil (West Texas Intermediate) price plunged to around $10/barrel in late 1998 and early 1999 (see Fig. 1). At the 107th OPEC (Organization of the Petroleum Exporting Countries) Ordinary Meeting (meeting) in Vienna on March 23, 1999, the OPEC 10 countries (excluding Iraq) pledged to cut production from previous quotas by 1.716 million barrels/day for 1 year effective April 1, leaving it with a production target of 22.976 million barrels/day.[1] Several non-OPEC countries (Mexico, Russia, Norway, and Oman) proclaimed their willingness to cooperate with cuts in their production of 388,000 barrels/day. The OPEC and non-OPEC countries cut production by a total of 2.104 million barrels/day. From Fig. 1, we see that the oil price shows a tendency to go up after the meeting.[2] Crude oil is the material which is indispensable when firms produce and provide goods and services. The increase of it is related to the problem of costs of goods and services. Thus, the movement of oil price affects the economic activity and have a serious problem for the oil-importing countries.

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[1] The OPEC decided to cut production by 2.60 million barrels/day at the 106th OPEC Ordinary Meeting.

[2] The amount of production target increased or decreased from 1999 to 2008. The oil price is rising diagonally up and to the right in the long-run.

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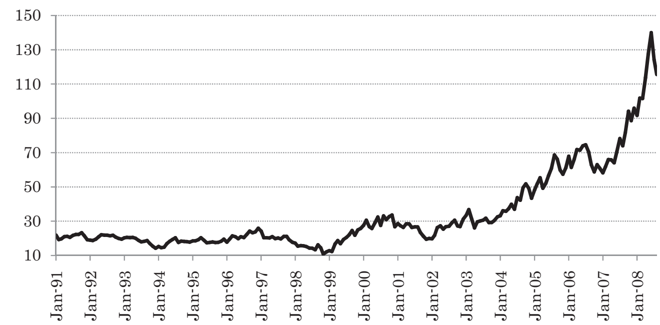

Fig. 1. World crude oil price. *Note*: WTI spot price (dollar per barrel). *Source*: U.S. Energy Information Administration.

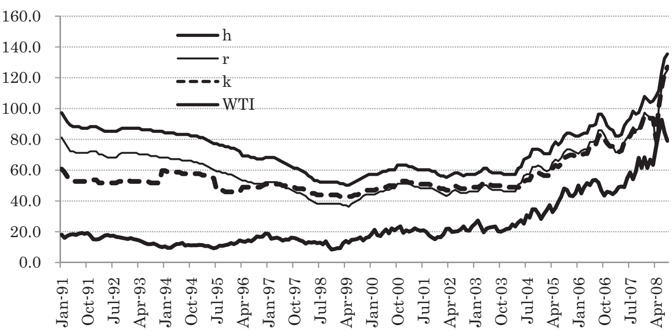

Fig. 2. Japanese oil prices. *Note*: *h*, *r*, and *k* denote the retail prices of premium gasoline, regular gasoline, and diesel (excluding consumption tax, gasoline tax, and gas oil delivery tax), respectively. And WTI denotes the spot price (yen per liter). *Source*: Japanese Oil Information Center and U.S. Energy Information Administration.

In particular, the increase in oil prices is a serious problem for Japan, because 99.7 percent of its oil consumption depends on imports. In Japan, the oil prices (excluding tax) of premium gasoline, regular gasoline, and diesel were about 51 yen/liter, 37 yen/liter, and 43 yen/liter in March 1999, respectively. In March 2008, the oil prices (excluding tax) of the premium gasoline, the regular gasoline, and diesel were about 105 yen/liter, 95 yen/liter, and 94 yen/liter, respectively (see Fig. 2). Japan has experienced oil shocks in the 1970s and the early 1980s. During these periods, the oil price changes affected the real economic activity through the supply and demand channels. The rise of the oil prices may lead to a situation similar to the previous oil shocks. Moreover, developed countries currently face problems with regard to the use of fossil fuel due to global warming. Further, measures to reduce CO_2 emissions, such as the Kyoto Protocol, have been implemented. These developments have a significant influence on economic activity.

There are many empirical studies on the relationship between the oil price and economic activity. Darby [1] analyzed the relationship between the increase of oil prices and the real income in eight countries. Darby estimates the long-run oil effect from 1957:Q1 to 1976:Q4 and provides the value of −0.191 in Japan. Hamilton [2] showed that the rise of oil prices is partly responsible for post-World War II US recession. More recently, the focus has been on the role that the volatility has on the economy.[3] Lee et al. [4] tested whether the level and volatility of oil prices affects the macroeconomic variable. Ferderer [5] investigated the effect on the US output to high volatility of oil prices.

There are some empirical literatures as to the relationship between the recent global energy situation and Japanese macroeconomic activity. Rebeca and Sánchez [6] focuses on the output growth, Cunado and Gracia [7] does on the inflation rate and the output growth, and Hanabusa [8] does on the output growth. Rebeca and Sánchez [6] analyzed the response of GDP to oil price shock using the seven-variable vector autoregressive (VAR) model from 1972:Q3 to 2001:Q4. Rebeca and Sánchez found that the oil price shock does not a negative effect on GDP growth in Japan. They consider that Japanese economy is resilient to the oil shock. Cunado and Gracia [7] investigated the oil prices–macroeconomy relationship using the Granger-causality test from 1975:Q1 to 2002:Q2. Cunado and Gracia found the increase of oil price changes Granger-cause the economic growth rate and the oil price changes Granger-causes the inflation rate in Japan. Hanabusa [8] examined the level (mean) relationship between the oil price and economic activity, and the influence of oil price variance from 2000:7 to 2008:3. From these previous literatures, we understand that oil prices play an informational role in the domestic economy. Because the meeting decision of OPEC affects the world crude oil price and domestic oil prices, it is important to investigate and discuss the effects of meeting.

[3] Ross [3] argues that the volatility of price is directly related to the rate of information flow to the market.

Table 1
Summary statistics on correlation coefficient of oil prices.

	h	*r*	*k*	WTI
h	1	–	–	–
r	0.983	1	–	–
k	0.812	0.878	1	–
WTI	0.601	0.697	0.905	1

Note: *h*, *r*, and *k* denote the retail prices of premium gasoline, regular gasoline, and diesel (excluding consumption tax, gasoline tax, and gas oil delivery tax), respectively. And WTI denotes the spot price (yen per liter).
The sample period is from January 1991 to August 2008.

This article aims to investigate the relationships between the oil price changes and macroeconomies before and/or after the meeting, using an exponential generalized autoregressive conditional heteroskedasticity (EGARCH) model and VAR model and the effects of meeting. The first step is to test whether there was a structural break in Japanese oil price changes after the meeting. The second step is to investigate the oil prices–macroeconomy relationship before and/or after the meeting.

The main findings of our study are the following. First, the high volatility of oil price changes occurs after the meeting. Second, there are evidence of Granger-causality between the oil price changes and macroeconomies after the meeting. We show that the uncertainty of oil price changes affects the inflation rate. This is pointed by Friedman [9] and Cukierman and Meltzer [10].

The rest of the paper is organized as follows. In Section 2, we explain in detail the movement of oil prices in Japan. We introduce the methodology in Section 3. Section 4 describes the data. In Section 5, we report empirical results of EGARCH model and Granger-causality and discuss these results. Section 6 summarizes our findings and concludes this paper.

2. Movement of domestic oil prices

Since Japan cannot produce crude oil, domestic oil prices depend on the world crude oil price. We calculate the retail prices of premium gasoline, regular gasoline, and diesel (excluding consumption tax, gasoline tax, and gas oil delivery tax; yen per liter), respectively, and the world crude oil price (yen per liter). We report in Fig. 2. From Fig. 2, we see that domestic oil prices change in the same direction as the world crude oil price. Using the sample period is from January 1991 to August 2008, we calculate correlation coefficients of oil prices and provide the result in Table 1. Table 1 denotes that domestic oil prices and the world crude oil price show high correlation.

Table 2
Chow stability test.

	F-Statistics (p-value)
h	17.078 (0.000)
r	6.664 (0.002)
k	4.009 (0.020)

Note: This table reports the structural break test for 1999:M3/M4.
We use the logarithm of variables of *h*, *r*, and *k*.
All regressions include a constant.
Numbers in round parentheses are *p*-values.
The sample period is from January 1991 to August 2008.

Next, we focus on the movement of oil prices before and after the meeting. Domestic oil prices are rising diagonally up and to the right after April 1999. This reflects to the decision of meeting. To clarify the change, we test a structural break in March/April 1999. Table 2 presents *F* statistics for the hypothesis of structural stability across the breakpoint 1999:March/April for the retail prices of premium gasoline (*h*), regular gasoline (*r*), and diesel (*k*), employing Chow test. These prices of premium gasoline, regular gasoline, and diesel are logarithm variables. The results in Table 2 show that we can reject the null hypothesis of no structural change in all domestic oil prices at the significance level of 10%. Thus, we confirm that a break happened with this period and the oil prices changed after the meeting.

3. Methodology

In this section, we explain the AR-EGARCH model and VAR model. In the first subsection, we investigate whether the volatility of oil prices shifted after the meeting or not. In the second subsection, we compare the relationship between oil price changes/oil price volatilities and economic performances before and after the meeting, using Granger causality test.

3.1. Application of AR-EGARCH model

Lee et al. [4] argues that the high volatility in oil price increases the uncertainty as to the economy and affects the investment decision making. Lee et al. uses the GARCH model to compute the unexpected component and conditional variance of real oil price. Sadorsky [11] employs the GARCH model to compute unexpected movements in oil price. We test whether the statement of meeting affects the volatilities of oil price changes. We employ the EGARCH (1,1) model following Nelson [12].[4] This model need not constrain the nonnegative condition in the variance equation. The model is specified as follows:

$$\begin{aligned} &x_{n,t} = c_{n,1} + \omega_n x_{n,t-1} + \varepsilon_{n,t}, \quad n = h, r, k, \\ &\varepsilon_{n,t} = \sqrt{v_{n,t}}\, u_{n,t}, \end{aligned} \tag{1}$$

$$\begin{aligned} \log(v_{n,t}) &= c_{n,2} + \alpha_{n,1}\left|\frac{\varepsilon_{n,t-1}}{\sqrt{v_{n,t-1}}}\right| + \alpha_{n,2}\frac{\varepsilon_{n,t-1}}{\sqrt{v_{n,t-1}}} + \beta_n \log(v_{n,t-1}) \\ &\quad + d_{n,1} D_{1,t}, \end{aligned} \tag{2}$$

$$\varepsilon_{n,t}|\Omega_{t-1} \sim N(0, v_{n,t}).$$

where

$$D_{1,t} = \begin{cases} 0 & (t < 1999/3), \\ 1 & (t \geq 1999/4), \end{cases}$$

Eq. (1) is the mean equation and Eq. (2) is the variance equation. $x_{n,t}$ represents the change rate of oil prices, and $D_{1,t}$ represent the constant effect of the meeting. *n* denotes the premium gasoline (*ch*), the regular gasoline (*cr*) and the diesel (*ck*). *ch*, *cr*, and *ck* are change rates. The error term is assumed to have a conditional normal distribution with a zero mean and a conditional variance, $v_{n,t}$.

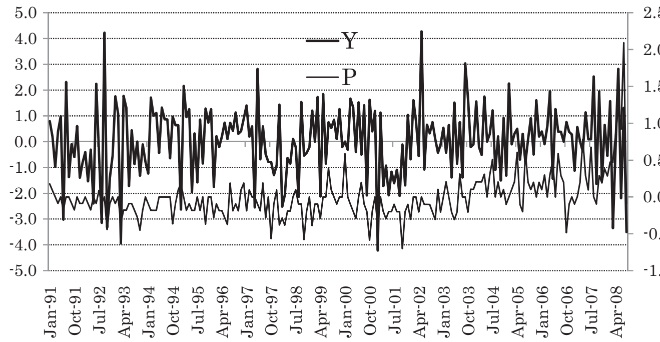

Fig. 3. Macroeconomic variables. *Note*: *Y* (left axis) and *P* (right axis) denote the change rates of (seasonally adjusted) industrial produce index and (seasonally adjusted) corporate goods price index excluding consumption tax (all commodities), respectively (%).
Source: Ministry of Economy, Trade and Industry and Bank of Japan.

In the EGARCH (1,1) model, the persistence of variance is measured by the magnitude of β_n and the asymmetric impact of residual is measured by the magnitude of $\alpha_{n,2}$. When the value of β_n approaches unity, the persistence of shock as to volatility is high. When the value of $\alpha_{n,2}$ is a negative and significant parameter, a negative shock greatly ($\varepsilon_{n,t-1} < 0$) affects the volatility. We report asymptotic standard errors for the parameters that are robust to departures from normality by using the consistent variance–covariance estimator of Bollerslev and Wooldridge [17].

3.2. Application of VAR model

The OPEC decides to cut crude oil production at the meeting. Then, the oil prices rise in Japan. We focus on the relationship between oil price changes and macroeconomy activities (growth rate and inflation rate) and analyze the effect of cutting crude oil production on these activities, using Granger-causality test.[5] Hamilton [2] examined the role of oil price in a version of the macroeconomic system which Sims [19] presented as a compact approximation to real activity. Rebeca and Sánchez [6] argued the relationship between oil prices and macroeconomic variables employing the Granger-causality test. In this paper, we set the model which is specified as follows:

$$\begin{aligned} y_t &= c_1 + \sum_{i=1}^{p}\phi_{1,i} Oil_{t-i} + \sum_{i=1}^{p}\phi_{2,i} p_{t-i} + \sum_{i=1}^{p}\phi_{3,i} y_{t-i} + u_{1,t} \\ p_t &= c_2 + \sum_{i=1}^{p}\psi_{1,i} Oil_{t-i} + \sum_{i=1}^{p}\psi_{2,i} p_{t-i} + \sum_{i=1}^{p}\psi_{3,i} y_{t-i} + u_{2,t} \end{aligned} \tag{3}$$

where y_t denotes the economic growth rate (*Y* or *YG*) and p_t denotes the inflation rate (*P* or *PG*) (Figs. 3 and 4). Oil_t is change rates of oil prices (*ch*, *cr*, or *ck*) or volatilities of oil prices (*vh*, *vr*, or *vk*), and $u_{1,t}$ and $u_{2,t}$ are a white noise process. The lag length is chosen by the akaike information criterion (AIC). To test whether oil price change/oil price volatility Granger-causes economic growth, we examine the null hypothesis H_0: $\phi_{1,1} = \phi_{1,2} = \cdots = \phi_{1,p} = 0$. Conversely, to test whether oil price change/oil price volatility Granger-causes inflation, we examine the null hypothesis H_0:

[4] The ARCH model is based on a principle discovered by Engle [13] and is extended by Bollerslev [14]. It is named the GARCH model. See Bollerslev et al. [15,16].

[5] See Granger et al. [18].

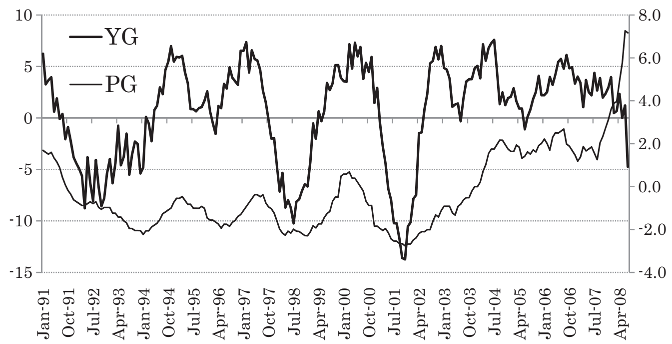

Fig. 4. Macroeconomic variables. *Note*: *YG* (left axis) and *PG* (right axis) denote the year-on-year change rates of (seasonally adjusted) industrial produce index and corporate goods price index excluding consumption tax (all commodities), respectively (%).
Source: Ministry of Economy, Trade and Industry and Bank of Japan.

$\psi_{1,1} = \psi_{1,2} = \cdots = \psi_{1,p} = 0$. *Y* and *P* are month-on-month change rates of index of industrial production and domestic corporate goods price index, respectively. *YG* and *PG* are year-on-year change rates of index of industrial production and domestic corporate goods price index, respectively. *vh*, *vr*, and *vk* are the square of deviation from linear trend of the premium gasoline, the regular gasoline and the diesel price. The following is the calculation of these volatilities.[6]

$$\begin{aligned} o_{i,t} &= w_i + \kappa_i\, trend + \varepsilon_t, \quad i = h, r, k, \\ V_{i,t} &= [o_{i,t} - (\hat{w}_i + \hat{\kappa}_i\, trend)]^2, \quad trend = 1, \ldots, T, \end{aligned} \tag{4}$$

$o_{i,t}$ is the price of premium gasoline, regular gasoline and diesel and $V_{i,t}$ is *vh*, *vr*, and *vk*.

First, we estimate Eq. (3) as to oil prices from 1991:1 to 1999:3. Then, we estimate it from 1999:4 to 2008:8. We investigate the relationship between the oil price change and economic activity. For estimation purposes, the following set of variables is used: oil price changes (price change rate of premium gasoline, regular gasoline, or diesel), economic growth rate, and inflation rate.

Second, we also estimate Eq. (3) as to oil price volatilities from 1991:1 to 1999:3. Then, we estimate it from 1999:4 to 2008:8. We investigate the relationship between the oil price volatility and economic activity. For estimation purposes, the following set of variables is used: oil price volatilities (price volatility of premium gasoline, regular gasoline, or diesel), economic growth rate, and inflation rate.

4. Data

We use the monthly data on the oil prices of premium gasoline, regular gasoline, and diesel, the seasonally adjusted index of industrial production, and domestic corporate goods price index excluding consumption tax (all commodities) in Japan.[7] The sample period is January 1991 through August 2008. The data source is the homepage of the Oil Information Center (OIC), the Ministry of Economy, Trade and Industry (METI), and Bank of Japan (BOJ).[8]

Tables 3–5 show the summary statistics on the change rate of oil prices. Table 3 is the full sample, and Tables 4 and 5 are sub sam-

Table 3
Summary statistics on change rate of oil prices (full sample).

	ch	*cr*	*ck*
Mean	0.182	0.280	0.406
Standard deviation	2.241	4.021	3.411
Skewness	1.569	3.406	2.237
Kurtosis	7.192	41.273	22.207
Jarque–Bera	241.043	13286.580	3419.273
p-Value	0.000	0.000	0.000
ADF(*C*)	−9.221**	−13.670**	−12.560**
Lag	0	0	0
ADF(*C*/*T*)	−10.066**	−14.476**	−13.162**
Lag	0	0	0

Note: This table reports mean, standard deviation, skewness, kurtosis, and Jarque–Bera statistic for oil price series.
The sample period is from January 1991 to August 2008.
p-Value is the probability value associated with the Jarque–Bera test statistic.
ADF corresponds to the regression including a constant term (*C*) and constant and trend terms (*C*/*T*).
†Shows that null hypothesis of a unit root is rejected 10% significance level.
*Shows that null hypothesis of a unit root is rejected 5% significance level.
** Shows that null hypothesis of a unit root is rejected 1% significance level. The lag length is selected by AIC (Max = 6).

Table 4
Summary statistics on change rate of oil prices (before a structural break).

	ch	*cr*	*ck*
Mean	−0.647	−0.785	−0.322
Standard deviation	1.022	1.291	2.537
Skewness	−0.995	−0.557	0.844
Kurtosis	4.318	3.707	25.987
Jarque–Bera	23.278	7.103	2169.204
p-Value	0.000	0.029	0.000
ADF(*C*)	−4.595**	−4.429**	−8.756**
Lag	1	1	0
ADF(*C*/*T*)	−5.113**	−4.805**	−8.713**
Lag	1	1	0

Note: This table reports mean, standard deviation, skewness, kurtosis, and Jarque–Bera statistic for oil price series.
The sample period is from January 1991 to March 1999.
p-Value is the probability value associated with the Jarque–Bera test statistic.
ADF corresponds to the regression including a constant term (*C*) and constant and trend terms (*C*/*T*).
†Shows that null hypothesis of a unit root is rejected 10% significance level.
*Shows that null hypothesis of a unit root is rejected 5% significance level.
** Shows that null hypothesis of a unit root is rejected 1% significance level. The lag length is selected by AIC (Max = 6).

Table 5
Summary statistics on change rate of oil prices (after a structural break).

	ch	*cr*	*ck*
Mean	0.926	1.214	1.046
Standard deviation	2.717	5.220	3.939
Skewness	1.013	2.454	2.273
Kurtosis	4.537	25.613	18.270
Jarque–Bera	30.159	2498.787	1184.570
p-Value	0.000	0.000	0.000
ADF(*C*)	−7.273**	−10.738**	−9.432**
Lag	0	0	0
ADF(*C*/*T*)	−7.463**	−10.840**	−9.752**
Lag	0	0	0

Note: This table reports mean, standard deviation, skewness, kurtosis, and Jarque–Bera statistic for oil price series.
The sample period is from April 1999 to August 2008.
p-Value is the probability value associated with the Jarque–Bera test statistic.
ADF corresponds to the regression including a constant term (*C*) and constant and trend terms (*C*/*T*).
†Shows that null hypothesis of a unit root is rejected 10% significance level.
*Shows that null hypothesis of a unit root is rejected 5% significance level.
** Shows that null hypothesis of a unit root is rejected 1% significance level. The lag length is selected by AIC (Max = 6).

6 To make the volatility with a structural break, we calculate it before and after the meeting. That is to say, *trend* = 1 is 1991:1 and 1999:4.

7 Many previous papers use the annual data and quarterly data series, but Burbidge and Harrison [20] and Ferderer [5] use the monthly data series.

8 Homepage Address of OIC: http://oil-info.ieej.or.jp/index.html. We use the average of the oil prices (yen/liter) in Japan, "Zenkokuheikin. We adjust the influence of the consumer tax. Homepage Address of METI: http://www.meti.go.jp/. Homepage Address of BOJ: http://www.boj.or.jp/index.html.

Table 6
Estimation result.

	ch (*p*-value)	*cr* (*p*-value)	*ck* (*p*-value)
$c_{n,1}$	−0.227 (0.004)	−0.385 (0.000)	0.088 (0.714)
ω_n	0.477 (0.000)	0.359 (0.000)	0.379 (0.000)
$c_{n,2}$	0.008 (0.866)	0.154 (0.416)	2.816 (0.017)
$\alpha_{n,1}$	−0.013 (0.831)	0.010 (0.962)	0.454 (0.057)
$\alpha_{n,2}$	−0.105 (0.035)	−0.523 (0.001)	−0.168 (0.197)
$\beta_{n,2}$	0.993 (0.000)	0.446 (0.013)	−0.520 (0.233)
$d_{n,1}$	0.056 (0.052)	1.397 (0.001)	0.175 (0.845)
Q^2 (20)	8.359 (0.989)	10.583 (0.956)	24.138 (0.236)

Note: Numbers in round parentheses are *p*-values.
Q^2 (20) is the Ljung-Box statistics with 20 lags for the standardized residual squares.

ple. By applying the augmented Dickey and Fuller [21,22] test (ADF test), we analyze whether or not the unit root existed in these variables. The lag length is selected by AIC (maximum length is six). The stationary of variables is required to obtain reliable parameter estimates and statistical inference. The results are shown in Tables 3–5. Since the null hypothesis of the existence of a unit root is rejected, these are stationary variables.

5. Empirical results and discussions

This section explains the empirical results for the EGARCH and VAR model described in the previous section. First, we examine whether or not the volatility of oil price changes increases after the meeting. Then, we analyze the relationship between oil price change/oil price volatility and macroeconomy after the meeting.

5.1. The change of volatilities after the 107th OPEC Ordinary Meeting

First, we examine the result for the EGARCH model (Eq. (2)). From Table 6, the persistence measures (β_n) for premium gasoline, regular gasoline, and diesel are given by 0.993, 0.446, and −0.520, respectively. The values of the premium gasoline and the regular gasoline are positive and statistically significant at the 10 percent level but value of the diesel is negative and statistically insignificant.

The asymmetric effect measures ($\alpha_{n,2}$) for premium gasoline, regular gasoline, and diesel are given by −0.105, −0.523, and −0.168, respectively. The values of the premium gasoline, the regular gasoline, and the diesel are negative and the premium gasoline and the regular gasoline are statistically significant at the 10 percent level. But the value of the diesel is not statistically significant.

The meeting effect ($d_{n,1}$) for premium gasoline, regular gasoline, and diesel are given by 0.056, 1.397, and 0.175, respectively. The estimated values of the premium gasoline and the regular gasoline are positive and statistically significant at the 10 percent level. However, the value of the diesel is positive and not statistically significant at the 10 percent level. From this result, the volatilities of premium gasoline and regular gasoline increases from April 1999. The regular gasoline price is volatile most. This high volatility of oil price may be related to Iraq War, the economic growth of emerging countries, and the increase in the investments in oils.

We find that the meeting causes the increase of not only the level of oil prices, but also the volatility of oil prices. We can consider that the increase in the level and volatility of oil prices causes the risk of the future economic activity. In the next subsection, as Lee et al. [4] and Ferderer [5] suggest that the movement of oil price may play an important role in affecting economy activity, we investigate the relationship between oil price changes/oil price volatilities and economic growth/inflation after the meeting.

5.2. The oil price and macroeconomy

Second, we examine the result for the Granger causality test. Tables 7–10 displays the Wald statistics and the *p*-values of the Wald statistics. Tables 7 and 8 report the empirical results of the causality between oil price changes and economic activities and the difference of table shows the sample period. And Tables 9 and 10 report the empirical results of the causality between oil prices volatilities and economic activities and the difference of table is the same as Tables 7 and 8.

Before the meeting, Table 7 denotes that the null hypothesis that *Oil* does not Granger-cause *Y* and *P* is accepted at all oils. However, the null hypothesis that *cr* or *ck* does not Granger-cause *YG* or *ch* does not Granger-cause *PG* is not accepted. Cunado and Gracia [7] shows the causality from oil prices (in domestic currencies) to economic growth rates (in industrial produce index). From this result, oil prices has close relation to the year-on-year change or quarter-on-quarter change of real activity but does not do the month-on-month change of real activity from January 1991 to March 1999. Rebeca and Sánchez [6] argues that oil prices do not affect the direct impact on GDP from 1972 to 2001, using the quarterly data. Thus, we can consider that oil price affects the change of longer-term economic activity or industrial products.

After the meeting, Table 8 denotes that the null hypothesis that *cr* does not Granger-cause *Y*, *P*, *YG*, and *PG* is rejected and that *ck* does not Granger-cause *Y*, *P*, *YG*, and *PG* is rejected. This result is consistent with the empirical work of Cunado and Gracia [7] and Hanabusa [8].[9] We find that the regular gasoline and diesel are useful in predicting the economic growth and inflation but the premium gasoline is not useful in predicting the economic activities after the meeting. Comparing with the result before the meeting, we confirm that oil prices have strong relation to the domestic activity after the meeting.

Table 9 shows that the null hypothesis that *vr* does not Granger-cause *P* and *PG* is rejected and that *vk* does not Granger-cause *Y* and *YG* is rejected. However, the null hypothesis that *vh* does not Granger-cause *Y*, *P*, *YG*, and *PG* is accepted. When we compare Tables 7 with 9, the premium gasoline or the variability of it hardly affects the direct impact on domestic activity from 1991 to 1999. This may be related to the price of premium gasoline. The premium gasoline is more expensive than regular gasoline and diesel and the demand of it is low. Thus, the amount of regular gasoline and diesel consumption is much and these fuels affect the economic activity.

Table 10 shows that the null hypothesis that *vr* and *vk* do not Granger-cause *Y*, *P*, *YG*, and *PG* is rejected and that *vh* does not Granger-cause *P* and *PG* is rejected. Hanabusa [8] provides the causality in variance between diesel and tertiary industry activity index. This paper and Hanabusa [8] are the same result. We find that the volatilities of oil prices have strong relation to the domestic activity after the meeting. Conrad and Karanasos [23] find that inflation significantly raised inflation-uncertainty in Japan. They point out the inflation-uncertainty and output relationship. Wilson [24] argues that increased inflation-uncertainty is associated with higher average inflation and lower average growth in Japan.

Therefore, we conclude that there is the close relationship between oil prices changes/oil price volatilities and macroeconomic variables after the meeting. The change rates and volatilities of regular gasoline and diesel are useful in predicting the economic growth and inflation rate and play an informational role for the domestic economy. Hanabusa [25] examined that three foreign disasters as to oil shocks – the September 11 terrorist attacks, Iraq War, and Hurricane Katrina – affected the stock prices of the Japanese

[9] This paper uses and investigates three kinds of oil prices but Cunado and Gracia [7] uses one oil price and Hanabusa [8] uses only diesel price.

Table 7
Granger causality test (before a structural break).

	Oil ↛ *Y*	*Oil* ↛ *P*	*Oil* ↛ *YG*	*Oil* ↛ *PG*
ch (*p*-value)	0.560 (0.454)	1.029 (0.311)	3.349 (0.341)	7.787 (0.051)
cr (*p*-value)	4.026 (0.134)	0.486 (0.784)	9.394 (0.025)	2.460 (0.483)
ck (*p*-value)	0.120 (0.729)	0.164 (0.685)	6.754 (0.080)	5.786 (0.123)

Note: This table reports the Granger causality test before a structural break.
↛ denotes 'does not Granger cause' between oil price and macroeconomic variable.
All regressions include a constant.
Numbers in round parentheses are *p*-values.
The sample period is from January 1991 to March 1999.

Table 8
Granger causality test (after a structural break).

	Oil ↛ *Y*	*Oil* ↛ *P*	*Oil* ↛ *YG*	*Oil* ↛ *PG*
ch (*p*-value)	0.188 (0.911)	1.878 (0.391)	3.689 (0.450)	3.561 (0.469)
cr (*p*-value)	12.377 (0.006)	28.903 (0.000)	13.737 (0.008)	15.247 (0.004)
ck (*p*-value)	13.389 (0.004)	26.569 (0.000)	12.813 (0.012)	15.245 (0.004)

Note: This table reports the Granger causality test after a structural break.
↛ denotes 'does not Granger cause' between oil price and macroeconomic variable.
All regressions include a constant.
Numbers in round parentheses are *p*-values.
The sample period is from April 1999 to August 2008.

Table 9
Granger causality test (before a structural break).

	Oil ↛ *Y*	*Oil* ↛ *P*	*Oil* ↛ *YG*	*Oil* ↛ *PG*
vh (*p*-value)	0.628 (0.428)	0.001 (0.970)	2.179 (0.536)	3.972 (0.265)
vr (*p*-value)	0.055 (0.814)	2.988 (0.084)	0.614 (0.893)	7.610 (0.055)
vk (*p*-value)	3.829 (0.050)	1.446 (0.229)	6.106 (0.047)	0.545 (0.761)

Note: This table reports the Granger causality test before a structural break.
↛ denotes 'does not Granger cause' between oil price volatility and macroeconomic variable.
All regressions include a constant.
Numbers in round parentheses are *p*-values.
The sample period is from January 1991 to March 1999.

Table 10
Granger causality test (after a structural break).

	Oil ↛ *Y*	*Oil* ↛ *P*	*Oil* ↛ *YG*	*Oil* ↛ *PG*
vh (*p*-value)	6.149 (0.105)	24.585 (0.000)	6.268 (0.281)	15.853 (0.007)
vr (*p*-value)	16.159 (0.003)	40.153 (0.000)	16.146 (0.006)	17.296 (0.004)
vk (*p*-value)	15.897 (0.014)	68.216 (0.000)	19.688 (0.001)	29.759 (0.000)

Note: This table reports the Granger causality test after a structural break.
↛ denotes 'does not Granger cause' between oil price volatility and macroeconomic variable.
All regressions include a constant.
Numbers in round parentheses are *p*-values.
The sample period is from April 1999 to August 2008.

petroleum industry. The change of oil price is related with the firm profits. The government and central bank need to pay close attention not to cause the recession and implement the appropriate fiscal and monetary policy to oil price shock.

6. Summary and conclusions

In this paper, we examined the impact of the 107th OPEC Ordinary Meeting (meeting), using the monthly data of the oil prices and macroeonomic variables. To analyze the movement of the oil prices before/after the meeting, we clarified a structural break in March/April 1999. Then we applied the EGARCH model and examined the shift of the volatility of oil prices. Our result revealed that the premium gasoline, regular gasoline, and diesel were the structural break and the volatilities of premium gasoline and regular gasoline increased after the meeting.

Before the meeting, we found that the regular gasoline and diesel Granger-cause the economic growth and the premium gasoline Granger-causes the inflation. The volatility of regular gasoline Granger-causes the inflation and it of diesel Granger-causes the economic growth. On the other hand, after the meeting, the regular gasoline and diesel Granger-cause the economic growth and inflation. The volatilities of regular gasoline and diesel Granger-cause the economic growth and inflation. The volatility of premium gasoline Granger-causes the inflation. In particular, the regular gasoline and diesel price have a useful information to predict the inflation and economic growth.

This implies that there is a close and strong relationship between oil price changes/oil price volatilities and economic activities after the meeting. Since the movement of domestic oil prices depends on the foreign policy and situation, the policy maker needs to focus on these events and must implement the policy analysis to reduce the risk of economic activity.

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